FINITE ELEMENT MODELING OF MICRO ANNULUS PHENOMENA IN CEMENTED WELLS

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Micro Annulus phenomena in cementing operations of oil or gas wells might be originated by several factors, three of the principal ones being cement contraction, water filtration and geomechanical effects. The resulting consequence of micro annulus derives in a poor isolation between formations and a net oil or gas production decrease.

The purpose of the current research is to use Finite Element Modeling as a tool for understanding the physical behavior of casing/cement and cement/formation interfaces under specific downhole conditions, by means of known input parameters defined by casing, slurry and formation properties. The simulation results are compared with experimental data obtained in the laboratory using gas migration equipment.

The finite element simulation is performed by a commercially available code. A two dimensional axisymmetric element formulation is utilized as the starting point of the behavioral analysis, which is lately compared with a more complex three dimensional formulation. Non linear elastic and plastic deformation models and thermal effects are considered in the computation. A cuasi-static time marching scheme is performed.

It is found that a proper physical understanding of the micro annulus phenomena originates after the good correlation between experimental and computer simulations. The final aim of the research is to create a tool to predict micro annulus formation in well cementing operations to help engineers prevent this problem.

References

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